

ORDINANCE NO. 1883

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF MILWAUKIE, OREGON, ADOPTING THE WATER SYSTEM MASTER PLAN.

WHEREAS, Oregon Administrative Rules (OAR) 333-061-0060 (5) (a) requires community water systems with 300 or more service connections to maintain a current master plan that is reviewed and approved by the Oregon Health Division; and

WHEREAS, the City of Milwaukie desires to be in compliance with the Oregon Administrative Rules (OARs); and

WHEREAS, the City of Milwaukie selected Montgomery Watson, a consulting engineering firm, to prepare a Water System Master Plan to meet the requirements of the Oregon Administrative Rules ; and

WHEREAS, the Oregon Health Division has reviewed and approved the Water System Master Plan; and

WHEREAS, the City Council held a duly advertised Public Hearing on February 20, 2001.

NOW, THEREFORE, THE CITY OF MILWAUKIE DOES ORDAIN AS FOLLOWS:

Section 1. Findings. The Master Plan evaluates the needs of the City's water system for at least a fifteen year period and includes the following elements:

A. A summary of the overall plan that includes the water quality and service goals, identified present and future water system deficiencies, the engineer's recommended alternative for achieving the goals and correcting the deficiencies, and the recommended implementation schedule and financing program for constructing improvements.

B. A description of the existing water system which includes the service area, sources of supply, status of water rights, current status of drinking water quality and compliance with regulatory standards, maps or schematics of the water system showing size and location of facilities, estimates of water use, and operation and maintenance requirements.

C. A description of water quality and level of service goals for the water system, considering, as appropriate, existing and future regulatory requirements, nonregulatory water quality needs of water users, flow and pressure requirements, and capacity needs related to water use and fire flow needs.

D. An estimate of the projected growth of the water system during the master plan period and the impacts on the service area boundaries, water supply sources and availability, and customer water use.

E. An engineering evaluation of the ability of the existing water system facilities to meet the water quality and level of service goals, identification of any existing water system deficiencies, and deficiencies likely to develop within the master plan period. The evaluation shall include the water supply source, water treatment, storage, distribution facilities, and operation and maintenance requirements. The evaluation also included a description of the water rights with a determination of additional water availability, and the impacts of present and probable future drinking water quality regulations.

F. Identification of alternative engineering solutions, environmental impacts, and associated capital and operation and maintenance costs, to correct water system deficiencies and achieve system expansion to meet anticipated growth, including identification of available options for cooperative or coordinated water system improvements with other local water suppliers.

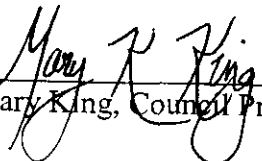
H. A recommended water system improvement program including the recommended engineering alternative and associated costs, maps or schematics showing size and location of proposed facilities, the recommended financing alternative, and a recommended schedule for water system design and construction..

Section 2. Adoption. The City of Milwaukie "Water System Master Plan" dated January 2001 and authored by Montgomery Watson is hereby adopted .

Read the first time on February 20, 2001, and moved to second reading by unanimous vote of the City Council.

Read the second time and adopted by the City Council on February 20, 2001.

Signed by the Council President on February 20, 2001.



Mary King, Council President

ATTEST:

APPROVED AS TO FORM:
Ramis, Crew, Corrigan & Bachrach, LLP



Pat DuVal, City Recorder



City Attorney



City of Milwaukee

Water System Master Plan
Executive Summary

January, 2001



EXECUTIVE SUMMARY

Introduction

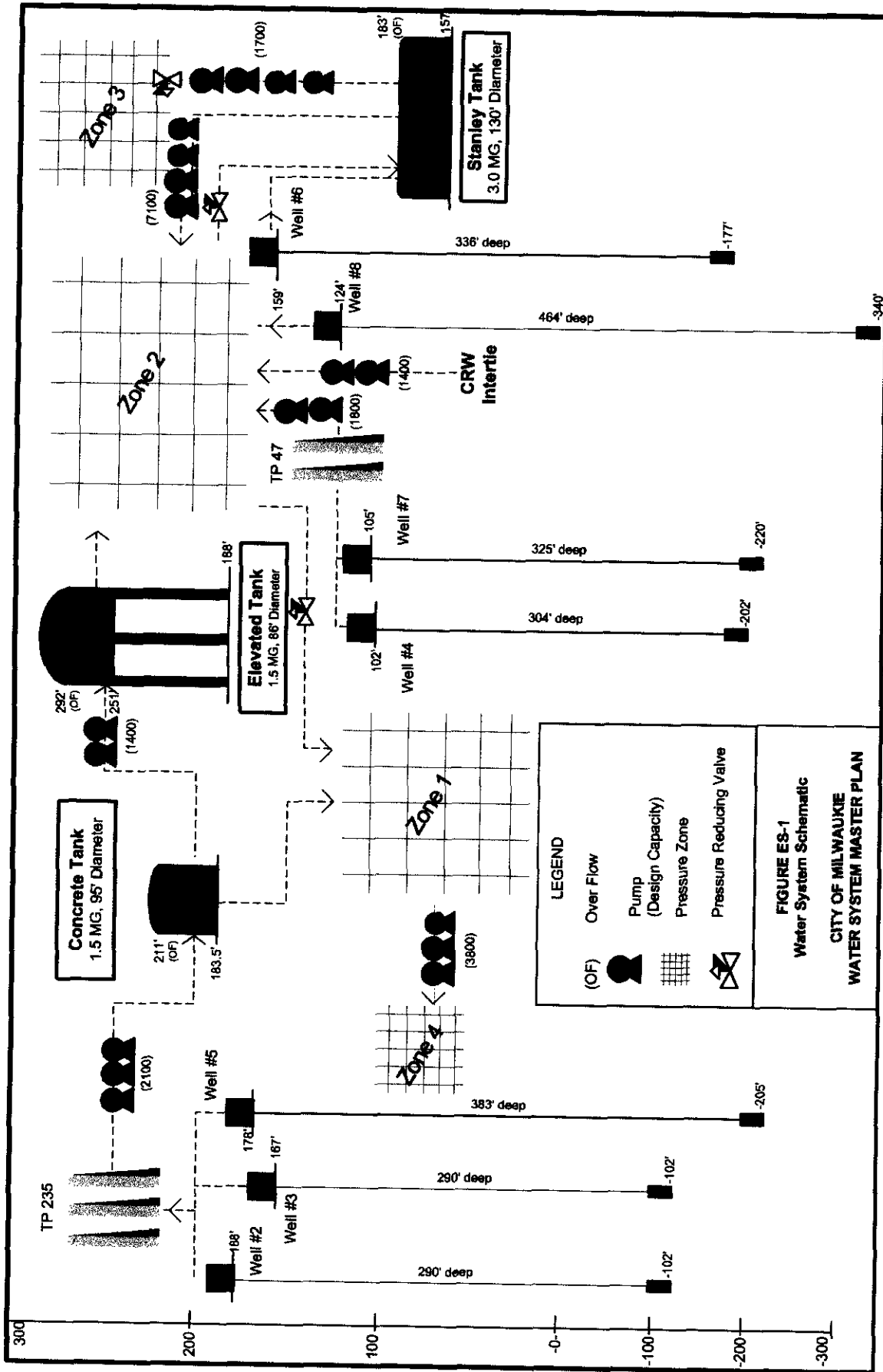
The City of Milwaukie provides about 5.8 million gallons a day (mgd) of water supply through a system of groundwater wells tapping the Troutdale Aquifer. Since August 1998, the City has supplemented its groundwater supply by purchase of approximately 0.5 mgd of surface water from Clackamas River Water (CRW). The City's water system includes approximately 100 miles of distribution and transmission pipelines, three reservoirs totaling 6.0 million gallons in storage, a pumping station, pressure reducing valves, and other facilities. A schematic of the City's water system is shown in Figure ES-1.

This Master Plan has been prepared to meet the requirements of the Oregon Health Division's (OHD) drinking water regulations and in partial fulfillment of the requirements of Goal 11, Public Facilities and Services, of the State of Oregon land use program. This Goal requires the City "to plan and develop a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for urban and rural development".

The major elements of the scope of work for this Water System Master Plan were to:

- Review and develop new forecasts of population and water demands,
- Develop planning criteria to be used in evaluating the existing system and future system expansions,
- Evaluate the existing system for deficiencies compared to the planning criteria,
- Develop a source of supply strategy;
- Identify the system improvements needed to support anticipated growth and development and provide means to anticipate system improvements before growth is constrained, and
- Prepare a Capital Improvement Program based on the evaluation of existing and future facilities,

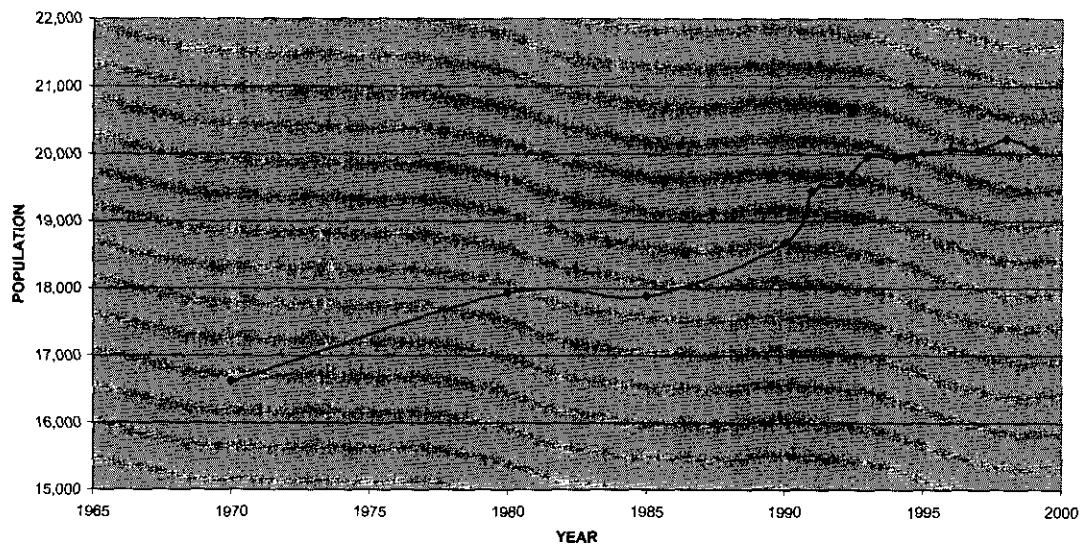
Determining water system rates or financing mechanisms was not a part of the Scope of Work for this Master Plan.



Population Forecast

Water demand forecasts require the estimation of two key parameters - the population that is to be served and the amount of water that population is likely to consume. Population trends over the decades since 1970 are illustrated in Figure ES-2. Population growth slowed significantly in Milwaukie in the early 1980's, in response to the state recession. Growth increased rapidly in the early 1990's and the City has been growing by an average of 0.8 percent per year since that time.

**FIGURE ES-2
MILWAUKIE HISTORICAL POPULATION ESTIMATES**



A number of potential sources and methodologies for forecasting the future population growth for the City are available. These include previous studies, figures from METRO, projections based on historical rates of growth, and the City's own Comprehensive Plan forecast that was adopted in 1999. These estimates are all fairly comparable.

Because the City's Comprehensive Plan forecast incorporates the most rigorous analysis of future development within the City that is currently available, it was used as the basis for population growth for this Master Plan. Based on this forecast, **the assumed total population served at build out will be 27,950 people**. It is also assumed that build out will occur by the year 2015. This number assumes that the City will fully annex Dual Interest Areas A and B, which are unincorporated areas contiguous to the current City boundaries.

Water Demand Forecast

Water demand refers to all the water requirements of a water system including domestic, commercial, municipal, irrigation, institutional and industrial as well as unbilled, unmetered and unaccounted-for water. Demands are discussed in terms of gallons per unit of time such as million gallons per day (mgd). Demands are also related to per capita use in gallons per capita per day (gpcd).

Water demand projections in a Master Plan must be large enough so that the facilities that are being planned will be adequate to cover future water needs in the community. At the same time, the demand forecast must not be too large, as then the planned facilities will also be too large and unnecessarily expensive. The balance between these two concerns must be found. It is important to understand that water demand projections are for planning purposes only. The final sizing and capacity of the recommended facilities should be evaluated and reviewed during individual project predesign to determine their appropriate sizing and other design criteria.

Predicting future water use has several inherent uncertainties. Per capita consumption in a community is influenced by many factors and can vary widely even between adjacent neighborhoods. Table ES-1 illustrates this fact for the City of Milwaukie. It shows historical water production figures for the years 1991 to 1998. Annual, maximum monthly and maximum daily production data and per capita consumption are shown in this Table. These figures include demand exerted by large portions of Area A, even though most of this area has not yet been annexed into the City. Some demand is also being exerted by Area B, although much of this area is currently being served by Clackamas River Water (CRW).

TABLE ES-1
HISTORICAL WATER DEMANDS WITHIN MILWAUKIE CITY LIMITS

YEAR	POPULATION	ANNUAL AVE DEMAND, MGD	MAX MONTHLY DEMAND, MGD	MAX DAILY DEMAND, MGD	RATIO OF MAX TO AVE ANNUAL DEMAND		PER CAPITA DEMAND		
					MAX MONTHLY	MAX DAILY	AVERAGE ANNUAL gpcd	MAX MONTHLY gpcd	MAX DAILY gpcd
1991	19,450	2.65	4.1	5.27	1.5	2.0	136	211	271
1992	19,550	2.68	3.96	5.74	1.5	2.1	137	202	294
1993	19,955	2.56	3.14	4.61	1.2	1.8	128	157	231
1994	19,930	2.67	4.23	5.41	1.6	2.0	134	212	271
1995	20,015	2.59	3.53	4.00	1.4	1.5	129	176	200
1996	20,065	2.75	3.91	4.89	1.4	1.8	137	195	244
1997	20,055	2.54	3.97	4.92	1.6	1.9	127	198	245
1998	20,220	2.47	3.87	5.14	1.6	2.1	122	191	254
1999	20,075	2.52	3.45	4.50	1.4	1.8	126	172	224

note: original data was not provided for years 1991, 1992. Figures taken from 1993 Water Source/Demand Study

As can be seen in Table ES-1, the peak day per capita consumption in Milwaukie varies considerably over this period, from a low of 200 gpcd to a high of almost 300 gpcd. This large a variation in peak demand over an eight year period of record is not uncommon in most communities. For comparison purposes, the peak day per capita consumption over the same period for Oregon City varied from 285 to 381 gpcd, and for the City of West Linn it ranged between 249 to 335 gpcd.

As can be seen by comparing Milwaukie with its neighboring cities, Milwaukie's per capita consumption was at the low end of the range observed in surrounding small cities. This low per capita usage reflects Milwaukie's character as an older, fully developed community. In newer, more rapidly growing communities, residential construction, development and irrigation are major water users. Milwaukie's per capita consumption figure is consistent with an established city, and is more similar to that observed in the City of Portland.

While the peak day per capita consumption can vary significantly from year to year due to the weather, there tends to be an upper limit in a community to the per capita consumption. Based on the distribution of the citywide values, it would not be unreasonable to expect peak day per capita consumption values up to approximately 5% higher than shown in Table ES-1 under extreme weather conditions. Thus, the citywide peak day per capita consumption could reach 300 gpcd in an extremely hot year.

For the purposes of this plan, it is recommended that 280 gpcd be used for peak day consumption for the year 2015 demand projection. This figure is at the high end of historically observed per capita consumption, and provides some system reliability to accommodate hot and dry weather. It also reflects Milwaukie's status as a stable, developed community that will grow mostly by redevelopment and infill over the next 15 years. **It is also recommended that the future average daily per capita demand be assumed to be 140 gpcd.** The peaking factor, defined as the ratio of average to peak daily demand then becomes 2.0, which is a reasonable and commonly used peaking factor, and is consistent with historical records for the City of Milwaukie.

The future water demand forecast is obtained by multiplying the recommended per capita usage rate by the recommended population forecast. The results of this calculation are shown in Table ES-2. It must be recognized that these estimates are predictions based on the best information available at this time, and should be subject to continuous updating and adjustment based on the actual water demand that the City experiences over time.

**TABLE ES-2
CITY OF MILWAUKIE
SUMMARY OF PROJECTED WATER DEMANDS**

YEAR	2015/Buildout
POPULATION	27,950
PEAK DAY PER CAPITA CONSUMPTION (GPCD)	280
AVERAGE DAY PER CAPITA CONSUMPTION (GPCD)	140
AVERAGE DAILY DEMAND (MGD)	3.91
PEAD DAY DEMAND (MGD)	7.83

Planning Criteria

Development of recommendations in this Water System Master Plan depend upon establishment of planning and analysis criteria which are used to evaluate the existing facilities and plan for new facilities. It must be recognized that these planning criteria are not hard and fast rules that must be exactly adhered to in order to provide a reliable water system. They are simply standards by which the system can be judged for the purposes of planning capital improvement and capital maintenance projects under most circumstances. The criteria that have been used in this Master Plan include:

Planning Period. This Water System Master Plan covers a 15-year period to the year 2015. This corresponds to the year of projected ultimate buildout for the City.

Planning Area. The planning area for the Master Plan is the limit of the current City of Milwaukie water system, plus Dual Interest Areas A and B. It is assumed that these areas will be annexed and fully developed by the year 2015, and that the City of Milwaukie will provide water service to these areas.

Service Pressure. The minimum pressure that must be maintained in the system per State of Oregon Health Division standards is 20 pounds per square inch (psi). This pressure must be maintained even during a fire flow event on a peak demand day. The typical operating pressures that are currently obtained from the existing tanks and reservoirs of between 45 psi and 170 psi should be maintained.

Source. The main source of supply should be capable of providing the projected peak day demand. It should meet this demand with firm capacity - that is, with the largest pump, filter or other component of the system out of service. The City should also have an emergency source of supply that is capable of providing the average day demand for the length of time that the primary source of supply is out of service, such period lasting up to a week. This emergency source could be provided through an intertie, storage, a secondary source, or other methods.

Transmission Pipelines. Transmission pipelines are considered as those greater than or equal to 10-inches in diameter. Pipeline flow velocities in transmission pipelines should be less than 5 feet per second. All water transmission pipelines greater than or equal to 18-inches in diameter should be capable of providing peak day demands. All other transmission pipelines should be capable of supplying peak hour demands.

Distribution Pipelines. Distribution pipelines should be sized to serve peak hour demands and fire flow requirements. Flow velocities for a distribution system pipeline should be below 10 fps and headloss in the pipeline should be below 10 ft per 1000 ft of pipeline. Minimum pipeline diameter for new distribution pipes will be 6-inches in diameter. Any pipeline below 6-inches should be upgraded before being equipped with a fire hydrant. A 6-inch line with a fire hydrant should be part of a looped system or be no more than 500 feet in length.

Pump Stations. Pump stations should be sized for a firm capacity equal to the peak day demand. For reliability, power supplies to pump stations should have either two sources of primary power feed, or one main source and standby or emergency power. The secondary power supply should be sized so that available pumping capacity is equal to average day demand, or fire flow, whichever is greater.

Storage. Storage facilities in water systems are generally provided for four purposes - equalization storage, operational storage, fire storage, and emergency storage. The total storage required in any tank or reservoir is the sum of these four components plus the dead storage (the volume of the tank that is unavailable to use due to physical constraints).

Equalization storage is needed in a water system to meet water system demands in excess of the transmission/pumping delivery capacity from the supply source to the reservoir. A value of 25 percent of peak day demand is recommended for equalization storage. Operational storage may be needed if the supply source does not continuously deliver

supply. The City of Milwaukie, however, does not operate its distribution system in a manner that requires additional operational storage beyond equalization storage, and thus, no additional operational component of storage is recommended in this Master Plan.

Fire storage is provided to meet the single most severe fire flow demand within the system or pressure zone served by the storage facility. The fire storage volume required is determined by multiplying the fire flow rate by the duration of that flow.

Residential fire flows are 1000 gpm for 2 hours and can be applied at any fire hydrant in the pressure zone. Commercial, industrial, and multi-family fire flows can be applied at any fire hydrant within areas that have appropriate land use zoning and may be specific to the zoning and actual facilities in place. A fire flow of 5,000 gpm for 10 hours is a conservative upper limit on storage requirements for zones with commercial, industrial and multi-family uses.

Emergency storage is provided to supply water from storage during emergencies such as power outages, equipment failures, pipelines failures or natural disasters. The amount of emergency storage provided can be highly variable and is dependent upon an assessment of risk and the desired degree of system reliability. An emergency supply equal to one day of average demand within a pressure zone is considered typical for most distribution systems and is appropriate for the City of Milwaukie's system.

It is also desirable, although not required, that storage be provided from at least two separate storage reservoirs or is available through pumping or gravity from a secondary reservoir at a different elevation. This provides for continuous operations during maintenance, repairs or reconstruction or modifications to any single reservoir.

Based on the above criteria, the total recommended required storage in each pressure zone will consist of 25% of projected peak day demand for equalization plus the fire flow demand plus one average day demand for emergencies. This is comparable to the storage requirements set forth in previous studies that the City has conducted.

Key Findings of the System Evaluation

The City's existing water system was evaluated in several ways in this Master Plan. These methodologies were field inspection of key facilities; a comparison of key facilities to the planning criteria; the development of a hydraulic model of the system; and a review of other data, information, and records in the City's files.

The Need for Additional Supply. As indicated in the planning criteria, the water system should be able to meet peak day demand with the largest single component of the supply out of service. The total current capacity of the City's groundwater source is 5.8 mgd and the current capacity of its surface supply from CRW is 0.5 mgd. This provides a total production of 6.3 mgd. The largest component of the supply system is Well No. 7, at 1.4

mgd. If this component is out of service, the resultant firm supply capacity is 4.9 mgd. This firm capacity is well below the projected peak day demand in 2015 of 7.8 mgd. Using a straight-line projection, projected peak day water demands will outstrip firm capacity by 2002, and will surpass ultimate production capacity by the year 2008. Therefore, it is recommended that 3 mgd of additional firm source capacity be acquired.

The Source of New Supply. The City has two basic alternatives to develop additional supply – to increase its groundwater production by the development of new wells, or to increase its purchase of surface supply from surrounding water providers. In the latter case, potential water providers are the City of Portland, Clackamas River Water (CRW) and the Oak Lodge Water District. The Oak Lodge Water District was eliminated from consideration after preliminary discussions with them indicated that it is not an option for the time period of this Master Plan. The remaining three alternatives were evaluated in more detail. The evaluation considered qualitative criteria and relative comparisons of costs. The qualitative criteria that were considered were:

- Certainty of Supply.
- Water Quality.
- Reliability.
- Ease of Implementation.
- Consistency with local and regional planning.
- Compatibility with existing facilities.
- Ownership and Agreements.

Cost considered capital, operating and maintenance costs.

The CRW and groundwater options were similar in cost, at about \$3.4 million over the life of the Master Plan. The City of Portland option was \$5.2 over the same period. The qualitative evaluation favored the CRW option. It ranked high on all the qualitative criteria and its use diversifies the City's sources and strengthens its emergency interconnections.

Water conservation was considered in this Master Plan as a method of delaying the need for additional water supply. It is important to note that current water demands in the City of Milwaukie already reflect conservation which has occurred in the region since the 1992 drought. The Portland Water Bureau estimates that a reduction in demand of 10 to 15 percent has occurred throughout the region in response to actions taken by water providers in 1992 and subsequent years. Milwaukie experienced a high per capita demand in the drought year of 1992 of 294 gpcd. Although there was a small spike upward in 1994 (another drought year), per capita consumption has so far not climbed back up to 1992 levels. In 1998/1999, per capita consumption was still 85 percent of the 1992 consumption rate. This suggests that conservation messages and practices continue to have an effect on consumption. By 2015, peak day demand is projected to reach 7.3 million gallons per day. This is a 50 percent increase over 1998/1999 peak day demands,

and will be fueled by population growth. Water conservation cannot replace the need for additional supply at these levels, but it may be able to affect the timing of necessary improvements. Conservation is therefore an important element of the City's overall water supply strategy.

To further strengthen emergency water supply, it is recommended that the City develop emergency interties and emergency supply agreements with its other neighboring water providers, the City of Portland and the Oak Lodge Water District. The City of Portland intertie is already under development. A previous intertie with the Oak Lodge Water District that is now inoperable should be reactivated.

New Storage. The City currently maintains 6 million gallons (MG) of storage in three reservoirs. Based upon the planning criteria for storage, the City needs an additional 1.5 MG of storage to serve its current population. This storage deficit will grow to 2.5 MG at buildout. Ideally, storage for each pressure zone would be provided from a reservoir that feeds that zone via gravity. However, the topography and location of reservoir sites in the City of Milwaukie has required that much of the City's existing storage be provided through pumping from lower elevations.

Several options for new storage were investigated in this Master Plan. The most economically favorable option to the City is joint storage with CRW at the site of their existing Otty Road Reservoir complex. CRW currently has excess storage capacity available at that site and can build more storage over time to accommodate growth for Milwaukie and CRW. Water stored at that site is of an elevation that allows for its use by gravity. Use of this site for storage also integrates with the recommendation for a new source of supply from CRW at this location. The Master Plan recommends pursuing joint storage with CRW. The planning-level cost for new storage at the Otty Road site would be about \$1.8 million. The City should explore cost sharing options with CRW based on current available storage and future needs of both the City and CRW.

Pipeline Improvements. Hydraulic modeling identified the need for approximately \$700,000 in pipeline improvements throughout the City. These improvements are needed to provide water to meet existing peak hour flows in some areas, to provide adequate flows to fight fires in other areas, and to meet the anticipated needs for water from growth and new development. Figure ES-3 illustrates the recommended pipeline improvement projects.

Small Diameter Pipelines. The City's current distribution system includes about 14 miles of 4-inch diameter pipeline or smaller. These pipelines cannot adequately deliver fire flows. The City is already aggressively pursuing a program of abandonment of these small diameter lines. It is recommended that the remaining pipelines be replaced over time as part of an ongoing long-term Capital Maintenance Program with a total replacement cost of approximately \$1.3 million.

City of Milwaukee Water System Improvement Plan

LEGEND

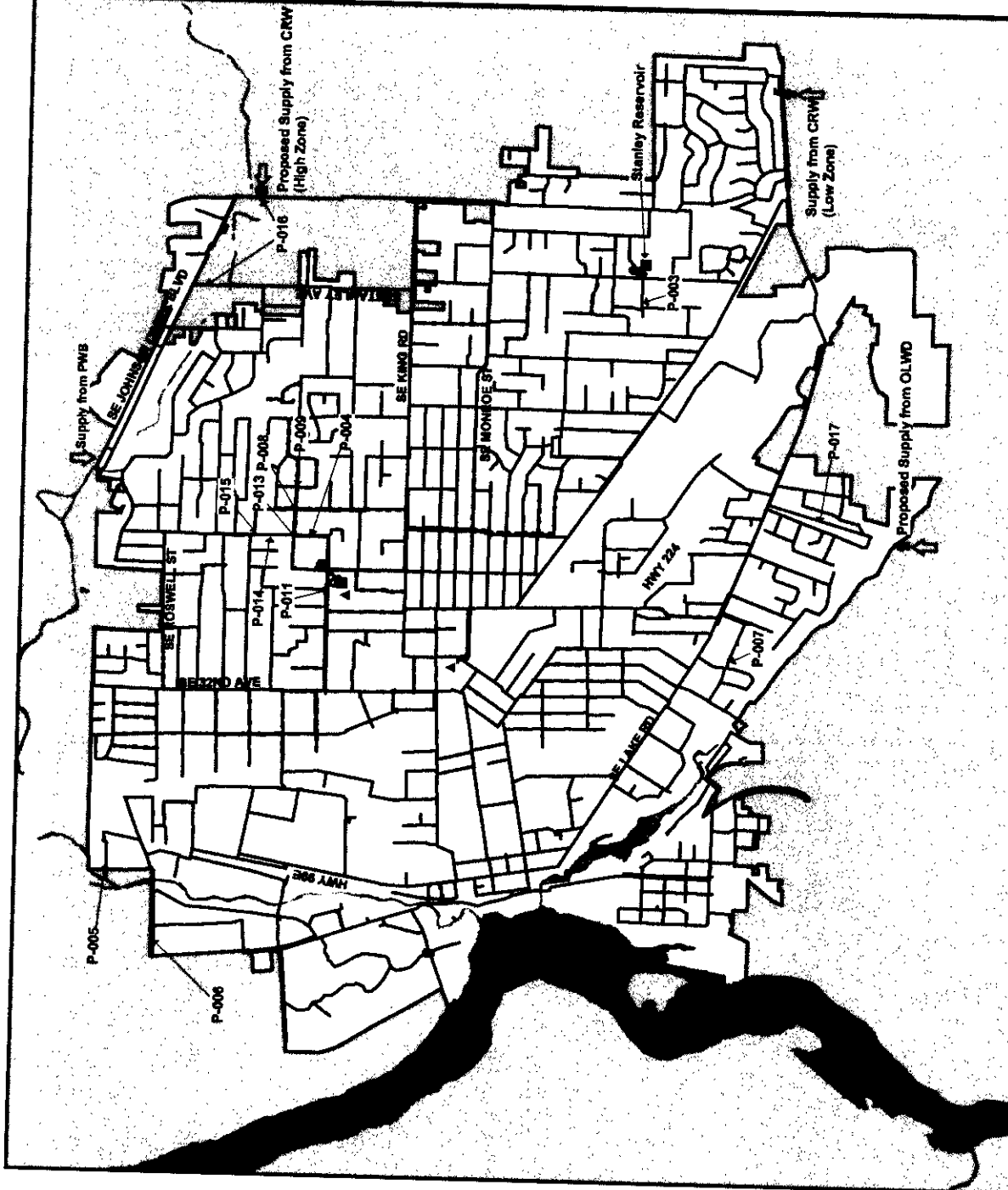
- Existing Conveyance System
- - - < 6" Pipeline Improvements
- Hydraulic Deficiencies
- Low Pressure (<40 psi)
- P-XXX CIP Project Number
(Dashed Line is P-001)
- Milwaukee Boundary
- Out of Study Area
- Reservoir
- ▲ Stripping Towers
- Pump Station

SCALE 1" = 1600'

IF THIS BAR DOES
NOT MEASURE 1"
THEN DRAWING IS
NOT TO SCALE

Pipeline CIP Projects

Figure ES-3



Summary

This Master Plan is intended to be a recommended plan and long-term guide for the development of the City's water system. Recommendations in this Master Plan result in a Capital Improvement Program totaling \$2.8 million over the next five years. Total capital needs from the current year (2001/2002) through buildout at 2015 are about \$4.5 million. While projects are listed in this Master Plan as being scheduled for construction in a given year, this is intended only to provide a general guideline of priorities, relationships between projects, and ties to levels of growth. Each year the City should review the Master Plan and adopt a specific Capital Improvement and Capital Maintenance Program which incorporates the general guidelines of the Master Plan into the specific activities for that year. The Master Plan should also be reviewed and updated every five years to account for changing circumstances and new information.